National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, MD 20771

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TO: 423/ESDIS Project Manager

FROM: 923/Darrel L. Williams

SUBJECT: Memorandum of Understanding Documenting Performance Requirements for the ESDIS LPGS

This memorandum is to document the performance specifications required of the ESDIS Level 1 Product Generation System (LPGS).

1. The Level 1 Product Generation System (LPGS) shall produce Level 1R and systematically corrected Level 1G Enhanced Thematic Mapper-Plus (ETM+) digital image data. Level 1R digital images shall be radiometrically corrected but shall not be geometrically resampled. Level 1G digital images shall be radiometrically corrected and resampled for geometric correction and geographic registration.

2. The LPGS shall provide the capability to process a volume of data equivalent to 25 standard Level 0R world-wide reference system (WRS) scenes to Level 1 digital images each day.

3. The LPGS shall generate Level 1 digital images corresponding to either heritage WRS scenes or to a partial ETM+ sub-interval. A partial sub-interval Level 1 product shall cover any contiguous portion of a sub-interval specified by a user with the following limitations. The specified portion is limited to a length between one-half and three WRS scenes (i.e., a length between 85 km and 510 km anywhere along the sub-interval).

4. The LPGS shall produce Level 1G digital images that are spatially continuous between contiguous partial sub-intervals or WRS scenes.

5. The LPGS shall provide the capability to generate Level 1G data products with a grid cell size that is variable from 15 meters to 60 meters in 1 millimeter increments.

6. The LPGS shall provide the capability to resample Level 1R digital images and apply the following map projections:

- Space Oblique Mercator
- Universal Transverse Mercator
- Lambert Conformal Conic
- Transverse Mercator
- Oblique Mercator
- Polyconic
- Polar Stereographic

7. The LPGS shall be able to create a Level 1G digital image oriented to a nominal path or to North-up at the option of the user

8. The LPGS shall provide the capability to generate Level 1G data products applying any one of the following three resampling methods:

- Nearest neighbor
- Cubic convolution
- Modulation transfer function (MTF)

9. In generating Level 1R and Level 1G data products, the LPGS shall:

- Contribute no more than .7% uncertainty to absolute radiometric accuracy during the generation of Level 1R and 1G digital images
- Contribute circular errors no greater than 1.8 meters, 1 sigma, in the production of systematically corrected Level 1G digital images
- Provide Level 1G products that are accurate within 250 meters cross track and 250 meters alongtrack
- Register pixels from one spectral band to the corresponding pixels of another spectral band from the same WRS scene or partial sub-interval to an accuracy of 0.28 sensor ground sampling distance (GSD), 90 percent, in along-track and cross-track directions providing all inputs are within specification. The accuracy is referenced relative to the largest sensor GSD of the registered bands.

10. The LPGS shall be able to produce Level 1R and Level 1G digital images for any subset of the nine spectral channels at the option of the user.

11. The LPGS shall be able to output Level 1 digital images in an HDF format, Fast format, or GeoTIFF format at the option of the user.

12. The LPGS shall have the capability to process Level 0R ETM+ data acquired during either the ascending or the descending portion of the Landsat 7 orbit to Level 1R and 1G digital images (i.e., the LPGS shall be able to process both daytime and nighttime ETM+ data to Level 1 digital images).

13. The LPGS shall be able to extract and process Landsat 7 ETM+ Earth image data from the Level 0R Earth image data file to product radiometrically corrected Level 1R digital images and systematically corrected Level 1G digital images from Level 1R images. The LPGS shall when generating Level 1 data products:

- Process payload correction data
- Extract parameters from the Level 0R internal calibrator/data or the calibration parameter file
- Calculate relative gains and biases from calibration data
- Process mirror scan correction data
- Detect the following image artifacts:

striping
banding
coherent noise
scan correlated shift
saturated detectors
dropped scan lines

- Characterize the following image artifacts:

striping
banding
coherent noise
saturated detectors
dropped scan lines

- Apply compensation for the following image artifacts:

striping
banding
coherent noise
memory effect
scan correlated shift
inoperable detectors
saturated detectors
dropped scan lines

- Apply compensation for gain changes within a requested Level 1R image as identified in the Level 0R metadata

14. The LPGS shall be able to assess Level 1 digital image quality.

Any questions regarding these requirements should be directed to Dr. James Irons, Code 923, 286-8978.

(signature on file)
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